WHAT IS CLAIMED IS:

1. A semiconductor device which comprises a capacitor of a stacked structure including a cylindrical storage node, a dielectric film and a cell plate, wherein said storage node has a cylindrical portion and a bottom portion; an outer wall of said cylindrical portion which is in contact with said dielectric film has a roughened surface; and an inner wall of said cylindrical portion has a smoothed surface.

2. A semiconductor device according to Claim 1, wherein silicon grains are formed in the outer wall of the cylindrical portion to provide projections and recesses in the outer wall surface, and the inner wall is composed of amorphous silicon.

3. A semiconductor device according to Claim 1, wherein the dielectric film is formed on the outer wall, the inner wall and the bottom portion of the cylindrical storage node.

4. A semiconductor device according to Claim 1, wherein an insulating film is formed so as to be in contact with the inner wall and an upper surface of the bottom portion of the cylindrical portion of said cylindrical storage node, the insulating film constituting the core of said cylindrical portion, and the dielectric film is formed on the outer wall of said cylindrical portion.

5. A method for producing a semiconductor device having a cylindrical storage node comprising a bottom portion

and a cylindrical portion which surrounds an outer circumference of said bottom portion and extends upward, which comprises:

a step of forming a contact hole which penetrates an interlayer insulating film formed on a semiconductor substrate;

a step of forming an electric conductive film on said interlayer insulating film whereby said contact hole is filled to obtain a contact to said substrate;

a step of forming an insulating film on said electric conductive film;

a step of patterning by an anisotropic etching said insulating film and said electric conductive film to form a configuration corresponding to said cylindrical portion so that the core and the bottom portion of said cylindrical portion are formed;

a step of forming the cylindrical portion on the side of said core and said bottom portion wherein an outer wall of said cylindrical portion is roughened;

a step of removing said core;

a step of forming a dielectric film to cover said cylindrical storage node comprising said cylindrical portion and said bottom portion; and

a step of forming a cell plate on said dielectric film, whereby a capacitor constituted by said cylindrical storage node, said dielectric film and said cell plate is formed.

6. A method for producing a semiconductor device according to Claim 5, wherein the step of forming the cylindrical portion on the side of the core and the bottom portion wherein an outer wall of the cylindrical portion is roughened, comprises forming amorphous silicon on said core and said bottom portion; roughening an outer surface of said amorphous silicon by forming silicon grains in the outer surface of it; and conducting an anisotropic etching for patterning to form a side-wall like cylindrical portion at the side of said core and said bottom portion.

7. A method for producing a semiconductor device according to Claim 5, wherein the step of forming the cylindrical portion on the core and the bottom portion wherein an outer wall of the cylindrical portion is roughened, comprises forming amorphous silicon on said core and said bottom portion; conducting an anisotropic etching to form a side-wall like cylindrical portion at the side of said core and said bottom portion; and roughening an outer surface of said amorphous silicon by forming silicon grains in the outer surface of it to thereby form said cylindrical portion.

8. A method for producing a semiconductor device according to Claim 6, wherein the roughening of the outer surface of the amorphous silicon is selected from the group consisting of a heat treatment with use of silane and a heat treatment in vacuum after a treatment to the

outer surface of said amorphous silicon with use of hydrofluoric acid, whereby projections and recesses are formed in the outer wall of said amorphous silicon by forming silicon grains in the outer wall.

9. A method for producing a semiconductor device according to Claim 7, wherein the roughening of the outer surface of the amorphous silicon is selected from the group consisting of a heat treatment with use of silane and a heat treatment in vacuum after a treatment to the outer surface of said amorphous silicon with use of hydrofluoric acid, whereby projections and recesses are formed in the outer wall of said amorphous silicon by forming silicon grains in the outer wall.

10. A method for producing a semiconductor device according to Claim 8, wherein the inner wall of the cylindrical portion having a roughened outer wall is constituted by amorphous silicon.

11. A method for producing a semiconductor device according to Claim 9, wherein the inner wall of the cylindrical portion having a roughened outer wall is constituted by amorphous silicon.

12. A method for producing a semiconductor device having a cylindrical storage node comprising a bottom portion and a cylindrical portion which surrounds an outer circumference of said bottom portion and extends upward, which comprises:

a step of forming a contact hole which penetrates an

interlayer insulating film formed on a semiconductor substrate;

a step of forming an electric conductive film on said interlayer insulating film whereby said contact hole is filled to obtain a contact to said substrate;

a step of forming an insulating film on said electric conductive film;

a step of patterning by an anisotropic etching said insulating film and said electric conductive film to form a configuration corresponding to said cylindrical portion so that the core and the bottom portion of said cylindrical portion are formed;

a step of forming the cylindrical portion on the side of said core and said bottom portion wherein an outer wall of said cylindrical portion is roughened;

a step of forming a dielectric film on said cylindrical storage node comprising said cylindrical portion and said bottom portion; and

a step of forming a cell plate on said dielectric film, whereby a capacitor constituted by said cylindrical storage node, said dielectric film and said cell plate is formed.

13. A method for producing a semiconductor device according to Claim 12, wherein the step of forming the cylindrical portion on the side of the core and the bottom portion wherein an outer wall of the cylindrical portion is roughened, comprises forming amorphous silicon

on said core and said bottom portion; roughening an outer surface of said amorphous silicon by forming silicon grains in the outer surface of it; and conducting an anisotropic etching for patterning to form a side-wall like cylindrical portion at the side of said core and said bottom portion.

14. A method for producing a semiconductor device according to Claim 12, wherein the step of forming the cylindrical portion on the core and the bottom portion wherein an outer wall of the cylindrical portion is roughened, comprises forming amorphous silicon on said core and said bottom portion; conducting an anisotropic etching to form a side-wall like cylindrical portion at the side of said core and said bottom portion; and roughening an outer surface of said amorphous silicon by forming silicon grains in the outer surface of it to thereby form said cylindrical portion.

15. A method for producing a semiconductor device according to Claim 13, wherein the roughening of the outer surface of the amorphous silicon is selected from the group consisting of a heat treatment with use of silane and a heat treatment in vacuum after a treatment to the outer surface of said amorphous silicon with use of hydrofluoric acid, whereby projections and recesses are formed in the outer wall of said amorphous silicon by forming silicon grains in the outer wall.

16. A method for producing a semiconductor device

according to Claim 14, wherein the roughening of the outer surface of said amorphous silicon is selected from the group consisting of a heat treatment with use of silane and a heat treatment in vacuum after a treatment to the outer surface of said amorphous silicon with use of hydrofluoric acid, whereby projections and recesses are formed in the outer wall of said amorphous silicon by forming silicon grains in the outer wall.

17. A method for producing a semiconductor device according to Claim 15, wherein the inner wall of the cylindrical portion having a roughened outer wall is constituted by amorphous silicon.

18. A method for producing a semiconductor device according to Claim 16, wherein the inner wall of the cylindrical portion having a roughened outer wall is constituted by amorphous silicon.